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The Fog of December 10th-11th, 1924

London Fogs from above

THE recent fogs which disorganised the normal routine and life of London and the South of England generally, provided an excellent opportunity of settling a number of questions which have for some years been the subject of much argument and discussion—intelligent and otherwise. Arrangements had been made for a kite balloon to be flown at the Croydon Aerodrome during foggy days and nights, for collecting reliable data regarding the visibility of lighting apparatus, and for investigating the possibility of devising ways and means of bringing aeroplanes into an aerodrome completely enveloped in one of London's "particulars."

During the first night's fog, this balloon was sent up from Croydon, and on reaching approximately 300 feet above ground level, came out into brilliant moonlight; the observers in the balloon looked down on an almost unbroken sea of swirling mist, the dirty white colour of which was reminiscent of the North Sea on a grey winter's day. During the ascent of the balloon through the 300 feet thick belt of fog nothing was visible in any direction, and all sounds coming up from the ground were muffled to an indistinctness that made them appear very far away. Once above the fog, the ground noises such as the roar of an aeroplane engine on test, the whistling of steam trains, the barking of dogs, and the shrieking discordance of motor horns came up in the

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* For Indian stations a rain day is a day on which 0·1 in. (2·5 mm.) or more rain has fallen.

fog with startling clearness, and the balloonists were irresistibly reminded of the game of "Blind Man's Buff"—voices everywhere, but nothing to be seen.

As the balloon rose completely clear of the last vestige of the swirling mists a few lighter patches breaking the grey monotony of the view showed up at different points. The most conspicuous of these patches was a red-tinted glow, reminiscent of a sunset seen through mist, but flashing on and off with mechanical regularity. This was the Neon Beacon which is installed at the Croydon Aerodrome as a guide to the night flying aviator, and which has been seen on clear nights at distances up to 45 miles. Some thousand yards or so to the East, a large patch of white light was seen moving slowly to and fro as the 36-inch searchlight (of over 250,000,000 candle power) was swung by the crew below. As the balloon rose these two lights (the beacon and the searchlight) became clearer and more easily recognised, and then a number of other lights were noticed and began to take definite character; high-powered experimental lights were seen first, and finally at 2000 feet it was possible to pick out individual lights of as low a brillancy as 300 candle power.

The general impression obtained from this first night ascent was that with a fog belt not more than 300 or 400 feet deep, it is a comparatively simple matter to indicate the position of an aerodrome to aircraft flying immediately over or very close to the aerodrome itself provided the craft are in the clear upper air.

The next set of observations was made during the forenoon of Wednesday, December 10th; on this occasion, the balloon went up just before mid-day, and the fog was found to be of about the same depth as on the previous evening. At 300 feet the balloon came into brilliant sunshine and within a few minutes the crew were unbuttoning the heavy leather flying kit which had failed to keep them really warm down on the ground; the sun's rays at this height and the complete stillness of the air brought memories of summer and a sympathetic pity for the earthbound workers condemned to grope their way around in a cold clammy cheerless world.

The same sound phenomena were noticed; ground noises were quite distinct, though in the fog everything had been damped down. At different points around the horizon, patches of high ground could be seen standing out of the fog bank and evidently enjoying the same brilliant sun that was warming the aeronauts. In general, the upper surface of the fog was comparatively level, but over the railway stations this evenness of surface was lacking, and large woolly mounds of fog projected in irregular formation above their surroundings; the variation in the height of these mounds at intervals led the observers to think that the presence of trains in the stations actually produced changes in the fog

above them, and this certainly seems to be the case. The railway stations at East Croydon and Purley were readily located by the uneven patches of fog above them. It was also noticed that the main-line connecting Croydon and Purley was quite distinct as there was an obvious furrow of uneven patches extending between the two stations. This phenomenon would not, of course, be of much value to an aviator endeavouring to locate his position as it was only by careful watching and a definite knowledge of their surroundings that the aeronauts were able to trace the line of railway.

Pyrotechnic star shells were fired up from the ground while the balloon was flying, and the resulting firework display some hundreds of feet above the fog surface provided a fresh interest; these star shells—red, white and green in colour—were very effective in their operation, but would not have been seen except by pure luck by an observer who did not know exactly in what direction to look for them. Apart from these projectiles fired above the fog, nothing was seen of the devices operated on the ground, which included various lights of high intensity. Among those enjoying the sunny warmth of an upper place were numerous birds—mostly starlings, which were flying about in a somewhat aimless fashion and occasionally perching on the cordage of the balloon. The majority of these starlings were very obviously lost, and many of them seemed completely exhausted, giving the impression that they had flown on and on above the fog in the hope of finding somewhere to land, and the balloon observers propounded the theory that some birds are almost as much handicapped in finding their way over unbroken fog as pedestrians are on the ground. Two seagulls were also seen flying steadily towards south-west—they apparently knew where they were going and seemed not in the least distressed.

Later observations made when the fog belt hung at between 500 feet and 900 feet above ground, produced an entirely different set of results from the lighting apparatus; on these occasions, no lights of any description were visible when the balloon was above the fog belt in a clear starlight night. At about 1200 feet and even on ascending to 3000 feet the same negative results were obtained.

The net conclusions were that with fog on the ground and only some 300-400 feet thick, powerful lights directed upwards can readily be seen by an observer high above the fog, but that when a fog belt is some hundreds of feet above the light sources it is not possible to project light through this belt. Another interesting point noted was that on some foggy nights red lights were most easily distinguishable and were seen at the greatest distance. On other nights on which the visibility was approximately the same, green lights were much better than red or

white lights, and on yet other occasions white lights were easily the best. The general impression gained at the conclusion of the experiments was that the fog bugbear which has baffled surface travel for generations and completely disorganises London's business, will be defeated to a very great extent by aerial transport, which has the advantage of being able to climb above the majority of fog belts and proceed across country guided by wireless telegraphy. This desirable state of affairs will not, of course, come into being without much careful and laborious research and experiment into the problem of getting departing aircraft safely up through the fog and bringing them down again through fog at their destination, but there is every indication that in a few years air services will be maintained with a regularity denied to surface organisations. C. H. BIDDLECOMBE.

Town and Country Observations

IT may be worth while to record some observations and impressions of the fog last week.

(1) It appeared much more of a mist than a fog. This is borne out by the fact that in the neighbourhood of Kingsway it was much less dense than in the northern suburbs. This was noticed both on coming in to town in the morning and on return at night, while information collected from others corroborated the observation. At night going home along a lane, not very well lit at the best, it was only under a lamp that the kerb could be seen, while in town one could always distinguish objects across the street.

(2) It is thus suggested that the heat of the town itself evaporated a certain proportion of the water particles near the ground and so cleared the air for a short vertical height. The smoke rose above the level of the houses, but was apparently then trapped, for it was quite as dark as on a dark night. Though there was no sign of the yellow fog, and there appeared to be comparatively little smoke at ground level, some unpleasant substances were present, as the eyes smarted.

(3) In the northern suburbs the fog appeared to be only a very dense mist drifting in from the north. Even though little air motion could be felt, the movement of the air particles appeared quite rapid, say three miles an hour.

(4) Notwithstanding the apparent cleanness of the mist or fog, I do not remember to have ever seen so much dirt left on the surface of the ground. All horizontal outdoor surfaces were coated with a very thin greasy-looking black film. Leaves, which had been lying on the grass during the fog, left a print of clean grass when picked up. Ground dug when the fog cleared contrasted strangely with ground dug just before the fog began.

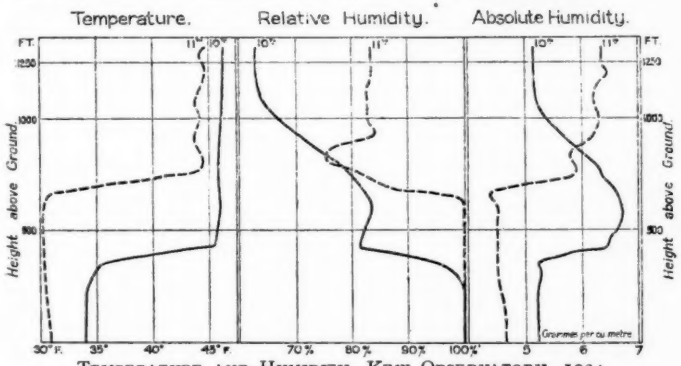
That this black film was not deposited just when the fog disappeared was evident from the fact that a doormat which had been repeatedly moved had left an impression of each of its overlapping positions clearly seen. The deposition of the film was evidently a continuous process.

With the oncoming of rain, the film disappeared entirely. The grass was washed quite clean, and there was apparently no difference between ground dug before and ground dug after the fog.

J. FAIRGRIEVE.

Temperature and Humidity in and above the Fog

AT Kew Observatory there is a captive balloon which can be sent up in fog. The apparatus used with the balloon for obtaining records of temperature and humidity was described in the *Meteorological Magazine* for August, 1923, *p.* 164. The instrument weighs about a pound, and was intended primarily to locate the upper limit of a fog rather than to yield very minute details. The scale of the records is rather small.



TEMPERATURE AND HUMIDITY, KEW OBSERVATORY, 1924
14h. 20m., DEC. 10TH, AND 10h. 40m. DEC. 11TH.

The graphs shown in the figure were obtained by Mr. L. H. G. Dines from soundings in the great fog of December 10th and 11th, 1924. On each of these days the balloon was sent up at a rate of about 400 feet per minute, and pulled down after a wait of four minutes. The average rate of descent was about 60 feet per minute, the procedure being to pull for one minute at the rate of 90 feet per minute and then to wait half a minute. This system was adopted so that any lag in the hygrograph or thermograph might be discovered and roughly estimated. Only the descending record was employed in preparing the graphs.

An unusual feature of the case was the almost entire absence

of wind at all levels reached, and, as the instrument is not artificially ventilated in any way, it will be appreciated that the hair hygrograph is bound to lag. The effect is clearly shown on the original records, and it is a fair inference that the level at which the relative humidity reached 100 per cent. was really in each case a little higher than the graphs indicate. The general shapes of the humidity graphs may, however, be accepted as correct, and as the instrument was specially calibrated on the 10th down to 72 per cent., the absolute values cannot be much out, but too much reliance should not be placed on minute details. The thermograph, being constructed of very thin metal, did not show any undue lag, and its record may be more confidently accepted. On both days the original record of temperature shows a slight but definite tendency to fall with increasing height up to the level of the inversion: above that the temperature was practically uniform, but the absolute humidity quite definitely was not. On the 11th the driest region was just above the inversion, on the 10th the dryness increased with height from 600 feet upwards. The latter feature is confirmed by an earlier ascent made on the same date.

The reduction in the absolute humidity inside the fog as compared with that just above the fog is due, of course, to condensation: on the assumption that the air had the same total water-content in and above the fog, the amount of water in suspension can be estimated. In the fog of December 10th the proportion of water in the gaseous and liquid states was about 5 gm./m^3 and 1·5 gm./m^3 respectively. On the 11th the corresponding figures were 4·5 gm./m^3 and 1·4 gm./m^3.

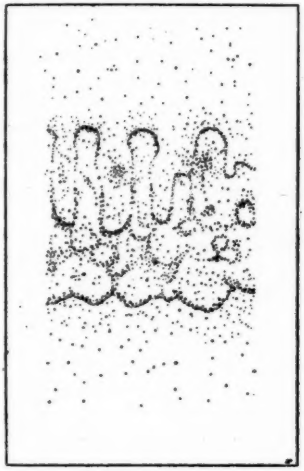
The dryness of the clear air above the fog on the 10th implies that its past history must have differed considerably from that of the lower air. This upper layer may have settled down from greater heights, or it may have drifted from the Continent over the stationary fog. On the other hand, the air which was over the Observatory on the 11th seems to have been derived from a single source of supply.

The slight decrease in temperature from the bottom to the top of the fog is consistent with heating by contact with the ground. At Kew Observatory the temperature at 12 inches below the surface of the soil was very steady at 40°, at 4 inches the temperature was 37°. There must have been a regular flow of thermal energy from soil to air. Mr. Fairgrieve's observations suggest that the heat from the soil causes the evaporation of some of the fog droplets, the warmed air with its water vapour ascends and the wet adiabatic lapse rate is thereby maintained through the fog. The convection is probably by currents on a rather coarse scale: it is well known that the air in a fog is seldom stagnant.

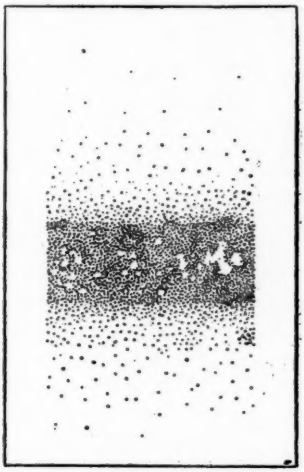
F. J. W. W.

Observations with the Jet Dust Counter

DURING the period of widespread fog between December 9th and 12th, 1924, London suffered from the usual combination of smoke and water fog which we have learnt to expect under such conditions at present. The following observations were made bearing upon the nature of the fog over London. A dust record taken at Cheam, about 11 miles south-west of London, on December 11th at 8h. 45m., using 50 c.c. of air, showed a



TYPICAL SECTION FROM DUST RECORD. CHEAM, SURREY. 11TH DEC. 1924. (NOTE STREAMBEDS AND SMALL DUST CONTENT.) MAGNIFICATION APPROXIMATELY 250 DIAMETERS.



TYPICAL SECTION FROM DUST RECORD. LONDON. 11TH DEC. 1924. (NOTE ABSENCE OF STREAMBEDS AND LARGE DUST CONTENT.) MAGNIFICATION APPROXIMATELY 250 DIAMETERS.

dust trace from the sides of which were large numbers of dried-up stream beds; the trace itself showed indications of a large quantity of water having impinged upon the glass. The number of dust particles was between 4,000 and 5,000 per c.c., with an average diameter of about half micron. The limit of visibility at the time was about 70 yards. On going to London a second record was taken at noon when the fog was about at its worst, and this showed little or no evidence of water and no lateral streams, while the number of dust particles was about 27,000 per c.c., and the diameters from 2 microns down, a large proportion being over 1 micron.

There was thus roughly 50 times as much impurity by weight in the London fog as at Cheam, while there was a much larger amount of water at Cheam. The small size of the particles at

Cheam points to the grading effect of settlement, while on the morning of the 11th, the roads in the neighbourhood were covered with a thin oily looking film, showing that active settlement was going on. It appears justifiable to infer from the above that the " London Particular " is formed rather by a replacement of water particles by smoke than by the dirtying of the condensed water by smoke, and this appears a reasonable result to expect from the higher temperature of the air over London. It further appears improbable that water vapour would condense round oily soot particles when there are ample numbers of hygroscopic nuclei present.

I have several times observed that during a white fog at Cheam the limit of visibility was less than in London, while the number of soot particles in London was invariably greater. It is hardly possible to get an improvement of visibility by adding smoke particles to the air unless there is a coincident reduction of the water particles.

J. S. OWENS.

OFFICIAL PUBLICATIONS

The following publications have recently been issued :—

PROFESSIONAL NOTES—

No. 35. Report on Observations of Atmospheric Electricity and Terrestrial Magnetism made at Kew, Stonyhurst and Eskdalemuir Observatories on the occasion of the Solar Eclipse, April 8th, 1921. By C. Chree, Sc.D., LL.D., F.R.S., H. W. L. Absalom, B.Sc., A.R.C.S., D.I.C., and E. Taylor, M.A., B.Sc. (No. 245*o*.)

RÉSEAU MONDIAL 1916. Part V. of the British Meteorological and Magnetic Year Book 1916. (M.O. 227*g*.)

Royal Meteorological Society

THE monthly meeting of this Society was held on Wednesday, December 17th, at 49, Cromwell Road, South Kensington. Capt. C. J. P. Cave, M.A., President, in the Chair.

C. E. P. Brooks, M.Sc.—The Problem of mild Polar Climates.

The benefits which the animal creation derives from the fact that ice floats on water instead of sinking to the bottom have often been emphasized. It is only recently that attention has been called to the other side of the question. Because ice floats, the Arctic regions wear a mantle of snow and ice, and such radiant heat as reaches the surface is mostly reflected away. Low

temperature breeds low temperature. Moreover, the icebergs, which are carried south, cool the surface waters of the Atlantic and reduce the warming power of the Gulf Stream. From such facts as these Mr. Brooks (following F. Kerner-Marilaun) shows that there is a break in the range of possible climates for the northern hemisphere. If the polar regions received in some way a little more warmth each year there might result a very great increase in temperature. According to the geological evidence there have been times when the climate, say at Spitzbergen, was as mild as that enjoyed at present by the Channel Islands. It is suggested that at these times, the Middle Eocene and Upper Jurassic, the distribution of land and sea was such that three wide channels led to the Arctic Ocean from more southerly latitudes, so that there was much opportunity for warm water to flow north and provide heat enough to ensure the ocean remaining open throughout the year. Mr. Brooks does not confine his attention to the distant past, and an interesting by-product of his investigation is the suggestion that as recently as the tenth century the Arctic Ocean was free from ice. In support of this suggestion he quotes (*inter alia*) the absence of any reference to ice in the Sagas which tell of the early voyages between Iceland and Greenland.

Sir Napier Shaw, F.R.S.—" Winds and Temperature in a dry Atmosphere."

At the meeting of the British Association at Toronto, Sir Napier Shaw read a paper with the striking title " If the World Went Dry." The paper has since been published in *Nature** Sir Napier gave an account of this paper and of some of the arguments on which it was based, and invited discussion. The hypothesis on which he proceeds is that air deprived of water vapour would be perfectly transparent both to light and heat. He comes to the conclusion that in middle and equatorial latitudes the atmosphere over any particular spot would be isothermal by night, and that by day gradual convection from the ground would warm the air in the lowest 6,000 feet ; the steady state would persist at greater heights throughout the 24 hours. To complete his picture, Sir Napier postulates lofty bosses (such as Greenland and the Antarctic) at the poles, and points out that the flow of cold air down the slopes of these bosses is a process which would persist even if the world went dry. There was a lively discussion which brought out some of the difficulties of the problem. For example, it was mentioned that we have no practical experience of an atmosphere entirely free from water. Sir Napier had utilised the records of diurnal changes of temperature in Egypt, but there is actually more water vapour in

*Nature, London, Vol. 114, 1924, p. 684.

the air of Egypt than in that of Great Britain. To trace the extent to which the range of temperature is affected by this water vapour is by no means easy, and Sir Napier rightly challenged his critics to improve on the estimates he had made in this and other parts of his paper.

Correspondence

To the Editor, *The Meteorological Magazine*

The Reform of the Calendar

THE letter from myself which you published in August on Calendar Reform, and on which Sir Napier Shaw made comment in November, certainly did assume that " the 13 months Year " and the " Dies Non " advocated by the U.S. Weather Bureau, were designed to cover many, if not all, departments of life. This assumption is borne out by a phrase used by Professor Marvin, who " would stop the wanderings of the days of the week through the months." This can mean nothing but a break in the sequence of week days, and that not only for meteorological purposes. It would mean that the first day of every month if once, say, Monday, would always be a Monday: that the Calendar for one year would be a Calendar for all years, except that in Leap Years there would be two days at the end which were not week days at all! It will not be admitted unanimously that there would be gain from such monotonous uniformity. The existing diversity from year to year may even be thought preferable.

It should, however, be well considered what this " Reform " is going to mean in ordinary life. It is a fact of tremendous importance that " a seven-day week with one Holy Day " is common to the three most widespread, if I may not say the most important, religions in the world—Jew, Christian and Moslem. The Jews have been keeping the seventh day as the Sabbath for more than 3,000 years: the Christians the first day as the Lord's Day for close on 1,900 years, and the Moslems the sixth day as their sacred day for full 1,300 years. There is no reason to think that the days of the week ever " got wrong." They hardly could have done. The *onus probandi* lies on those who would say that they did. Even the considerable upset caused in 1582 and after by the Gregorian Calendar Reform did not touch the days of the week. Moslems, Jews and Christians (Latin, Greek or Protestant) went on with their Fridays, their Sabbaths and their Lord's Days just as before. It will be a very serious matter to break the sequence of week days. It will be a matter of conscience. Where is the authority that can impose obedience on all these? A pity indeed to begin the quest for uniformity

by breaking up the greatest bond of agreement that the world has yet seen!

One may earnestly desire a very radical revolution in the Civil Calendar, and yet plead that the sequence of week days, and the Lunar Basis of the Christian Easter shall be left untouched. Other ways are open.

H. A. Boys, F.R.Met.Soc.

Spring Hill, S. Mary Bourne, Andover. December 3rd, 1924.

Shakespeare's Use of Meteorology

To think of and represent Nature as manifesting sympathy with human emotions has been a favourite conceit of poets all down the ages, and Shakespeare has not been behindhand in employing this device in his works. How the terrible scene of Lear's madness is enhanced by the storm in the external world which seems to match the storm in the old king's soul; and what an atmosphere is created in "Macbeth" during the tryst of the three weird sisters on the blasted heath and on the night Duncan is slain.

Another great storm in Shakespeare is the storm before Cæsar's death. Casca, meeting Cicero, says:—

> "I have seen tempests, when the scolding winds
> Have riv'd the knotty oaks; and I have seen
> The ambitious ocean swell, and rage, and foam,
> To be exalted with the threat'ning clouds:
> But never till to-night, never till now,
> Did I go through a tempest dropping fire.
> Either there is a civil strife in heaven;
> Or else the world, too saucy with the gods,
> Incenses them to send destruction." (Act i., 3)

Shakespeare's last play is about a "Tempest." But the period of the tragedies, the period of storm, was then over for ever, and that "Tempest" was a wind which blew nothing but good.

Cicely M. Botley.

10, *Wellington Road, Hastings. December 11th,* 1924.

Sunshine and Shadow on Christmas Eve

We had quite a sharp thunderstorm here on the 24th. Rain began at 10h. 20 m., and lasted till 11h. 30 m., in which time 0·32 in. fell. About 11h. there was a flash of lightning, followed by a very loud and long rumble of thunder. There was another flash and clap nearer afterwards, and one or two more distinct claps. The storm came up from the southwest with the wind. Later there were more storms of rain, making a total for the 24 hours of 0·72 in., and at 15h. 30m. it was too dark in the house

to see needlework. Then the sun came out and, reflected from a cloud in the southeast, made the eastern rooms almost lighter than the western, the cloud looking a bright soft yellow. I hear there was a very fine rainbow and fine effects from wet roofs.

ELEANOR M. TAWNEY.

114, *Northmoor Road, Oxford. December 26th*, 1924.

Great Variation in (Local) Annual Rainfall

IT is a remarkable fact that this last leap year period (1921-1924) has supplied me with the greatest contrast in annual rainfall I have ever registered personally; and, so far as I can trace, the greatest contrast ever noted about London. My own record for the year 1921 was 15·46 in.; for 1924, 37·88 in.; the difference being roughly 144 per cent. I am wondering whether any greater oscillation than this has ever been noted in the neighbourhood of London.

WILLIAM GODDEN.

20, *Richmond Avenue, Willesden, N.W.* 10. *January 5th*, 1925.

NOTES AND QUERIES

The Week-spell Calendar

IN the *Meteorological Magazine* for November, 1924, Sir Napier Shaw announced his intention to make a calendar for 1925 to show the division of the year into "week-spells." On New Year's Day Sir Napier's friends received a booklet containing "The Kalendar for 1925," as well as much useful information about the radiation observations made at English observatories during 1924 and now set out in the appropriate week-spells.

In 1925, each week-spell will begin with Thursday (for New Year's day was on Thursday). In 1924, the week-spells began with Tuesday at the beginning of the year, with Wednesday at the end. The change occurred after the 8-day week which according to Sir Napier was from Tuesday, June 24th, to Tuesday, July 1st. Some meteorologists may think that it would be better to allow the 8-day week to be the week in which February 29th falls. The Book of Common Prayer allots a letter to each day of the year. January 1st has the "Dominical Letter" A. January 2nd, b, and so on. The sequence A . . . . g, A . . . . g is interrupted only by February 29th to which no letter is allotted. If these letters are regarded as giving names to the days A-day, B-day, etc., then February 29th which falls between a C-day and a D-day will require a name, say L-day. With the Prayer book convention a day such as June 2nd would have the same

designation, F-day, Week-22, every year. With Sir Napier's rule, June 2nd is an F-day in ordinary years, but a G-day in leap years. Each system has its advantages.

The tabulation of observations by week-spells is unobjectionable as long as it is confined to data of purely scientific interest. It is to be remembered, however, that the distinction between pure and applied science is always ill-defined. To many the Weekly Weather Report of the Meteorological Office is a purely scientific document. It is intended, however, to supplement the returns of the Registrar General and the Board of Agriculture and should be governed by the same rules. Would the adoption of the standardized weeks in those returns be practicable or popular ?

Estimation of Height of Low Cloud

WITH a view to discovering to what degree of accuracy it may be possible for an experienced observer to estimate the height above ground of the base of low cloud, tests have been conducted recently at the meteorological stations at Andover and Biggin Hill. During the period of the tests, three months, the observers entered each morning in the pocket register an estimate of the height of any low cloud that was present, this being done before any measurement for that day was made ; whenever the clouds were suitably placed their heights were measured by timing a pilot balloon till it entered one, it being assumed that the rate of ascent of the balloon was correctly given by the usual formula as a fraction of the weight and " free lift."

The results obtained indicate the high degree of proficiency which can be acquired in making estimates of this sort by men who for several years have been making daily observations of cloud height by means of pilot balloons and otherwise. At the first station, Andover (200 ft. above sea level), where the cloud height as measured varied from 250 to 5,500 feet (most of the cases being below 3,000 feet), the " probable error " in the estimate worked out at about 150 feet. At Biggin Hill (600 ft. above sea level), cloud height varied from 100 to 3,000 feet, and the " probable error " was found to be about 220 feet. The first station is on the east side of Salisbury Plain, in reasonably level surroundings, and the staff have all been there for some years. The second station is on the North Downs, a ridge which itself plays a large part in local cloud formation ; moreover, conditions were less favourable for this comparison in that two out of the three members of the staff had recently been transferred from other places and were consequently less familiar with local conditions. At both stations the tendency was towards underestimation.

Meteorology and Terrestrial Magnetism
Magnetic Quiet and Disturbed Days

THE British representatives on the Meteorological Section of the International Union of Geodesy and Geophysics gave, at Madrid, their support to a proposal that a comparison should be made between meteorological conditions on days characterised by quiet and disturbed states of terrestrial magnetism. The proposal, which is due to Dr. Chree, and was mentioned in his last presidential address to the Royal Meteorological Society, was not adopted by the International Union, but it is to be hoped that such a promising line of research will not be neglected. The "magnetic character" of each day is reported monthly to de Bilt from about 40 observatories, and by the aid of these reports five quiet days and five disturbed days are selected. The statistics are published in bulletins issued by the Institut Meteorologique Royal des Pays Bas: there are four quarterly bulletins and an annual one. From the last two quarterly ones we copy the lists of quiet and disturbed days for the first half of 1924:—

	QUIET.					DISTURBED.				
January ..	1	12	13	14	20	10	22	23	29	30
February ..	14	15	18	28	29	5	6	20	21	23
March ..	1	14	15	17	28	7	8	20	30	31
April ..	4	5	11	13	30	6	7	17	25	26
May ..	6	7	14	18	31	2	22	23	24	28
June ..	3	6	7	8	14	10	11	18	19	20

For any meteorological influence it would be natural to look to the phenomena on the five disturbed days. These are the likely days for aurora. If for example the daily range of temperature is affected by the same causes as produce the magnetic storms, a comparison of the daily range on the five disturbed days with that for the whole month should bring out the relation. When there is a sequence of two or three disturbed days the chances of detecting an interconnection with other geophysical elements should be enhanced.

Air Temperature Near the Ground

REMARKABLE results were obtained in some observations of air temperature reported recently* by Monsieur W. Mörikofer, of Bâle. In his experiments the air temperature was determined by ventilated thermometers. Over ground heated by direct sunshine the lowest layers were hotter than the free atmosphere,

* W. Mörikofer (Bâle).—La température de l'air dans la couche d'un mètre d'épaisseur au-dessus du sol. *Compte Rendu de la séance de la Société Suisse de Géophysique, Météorologie et Astronomie.* (G. H. A.)

the excess amounting in some cases to 10°C. The excess persisted up to 50 cm., but between 60 cm. and 90 cm. all the observations showed a stratum of air a little colder than those above and below it. A similar phenomenon was noticed over an area of snow surrounded by pasture. Immediately above the snow the air was at 0°C.; at 10 cm. the temperature of the free air was reached, but from 40 cm. to 80 cm. there was a layer 0·5°C. colder.

Researches on air temperature are numerous and it is hardly to be supposed that such paradoxical phenomena could have escaped notice hitherto. It is to be hoped that Monsieur Mörikofer will continue his experiments and find the explanation of the anomalies.

Investigation of Winter Thunderstorms, 1925

Mr. S. Morris Bower proposes to continue, in conjunction with the Meteorological Office, the annual record of winter thunderstorms hitherto made by Capt. C. J. P. Cave, of Petersfield: this can only be carried out with the assistance of observers in all parts of the country. Mr. Bower would therefore be glad if observers would send to the address given below particulars of any thunder or lightning they may observe between January 1st and March 31st, 1925, inclusive.

A simple note of the date and time of the occurrence of thunder and lightning in any place and the direction in which the lightning was seen, especially at night, would be very valuable. Any additional information would be extremely welcome, as for instance:

(i.) An estimate of the severity of the storm.
(ii.) The time when the storm passed overhead, if it did so, and how long it lasted.
(iii.) Whether it was accompanied by rain, hail or snow.
(iv.) Direction and strength of wind; change of wind, if any.
(v.) Whether there was a change in temperature during the storm.
(vi.) Any other observation which may be of particular moment.

Reports from all parts of the country are desired, especially from Scotland, Ireland and the North of England.

Notes should be sent by postcard or letter to Mr. S. Morris Bower, Langley Terrace, Huddersfield.

The Rainfall of 1924

It has only been possible so far to ascertain in broad outline the features of the rainfall of 1924. There is no doubt that over the country as a whole the year was unusually wet, the general value

for the whole British Isles being provisionally computed as 117 per cent. of the average, or as 48·5 in. According to this estimate the year was wetter than any since 1903, when the general rainfall was 127 per cent. of the average, or 52·5 in. The rainfall of 1924 only slightly exceeded that of the years 1916 and 1912, which had 115 and 116 per cent. of the average respectively. Although 1924 stands out as a wet year, there were considerable areas over the British Isles in which the rainfall for the year did not reach the average. Less than the average occurred over a broad band stretching from Glasgow and Fort William in the west to Elgin, and also in the valley of the Tweed and over a large area stretching inland from the Lincolnshire coast as far as Barnsley. At Louth, in Lincolnshire, the fall was only 89 per cent. of the average.

In most parts of Scotland the total for the year was within 10 per cent. of the average, and it was only along the east coast from Aberdeen to Dundee that as much as 120 per cent. occurred. In Ireland the fall everywhere exceeded the average, and more than 120 per cent. was recorded over a large area. In parts of Down, Sligo and Wexford the total for the year exceeded 130 per cent. At Ballinrobe, near Loch Mask in Mayo, the largest annual total since the record began in 1877 was recorded. It was in England and Wales that the greatest excesses occurred. Falls of more than 120 per cent. were widespread. More than 120 per cent. occurred everywhere to the south-west of a line from Snowdonia to the Thames Estuary, except along a coastal strip of Wales. More than 140 per cent. occurred on Dartmoor, on the Cotswolds, and over small areas to the north of London e.g. at Maidenhead and Chelmsford. At High Wycombe, in Buckinghamshire, the fall was 38·94 in., being 13·04 in., or 50 per cent., above the average, and the largest total (with the one exception of 1903) since the record began in 1846. At Camden Square (London) the fall for the year of 33·08 in. was 8·61 ins., or 35 per cent., above the average. This was the largest total since 1916. There were 188 days with rain, the duration of rain was 539·6 hours, and the evaporation from a free water surface 14·47 in.

The year opened with a month of heavy rainfall giving 125 per cent. of the January average, but both February and March were unusually dry, the fall over the whole country being only about half the average in both months. February, 1924, was not nearly as dry as the February of the famous dry year 1921, while March was the driest March over the British Isles as a whole since that of 1900. March presented an unusual feature in that less than 1 in. of rain (and less than 10 per cent. of the average) fell in parts of the western Highlands of Scotland. November was the only other month with less than the average over the country as

a whole. May and September were both extremely wet; May, 1924, being the wettest May since before 1881, and September the wettest September since before 1881 with three exceptions, 1918, 1896 and 1885. In May the fall exceeded twice the average over the greater part of England and Wales, while in September more than twice the average occurred in the south-west of England and Wales, but more notably in the south-eastern half of Ireland. In December the fall over the country as a whole was 127 per cent. of the December average, or as much as 6 in. This was the largest value in inches for any month of 1924. In August more than four times the average fell in the small area affected by the intense fall of the 18th, when at Cannington, near Bridgwater, 9·4 in. was recorded for one day, and at least 8 in. of this amount fell in 5 hours.

Review

Wettervorhersage die Fortschritte der Synoptischen Meteorologie. Von Dr. Walter Georgii. Wissenschaftliche Forschungsberichte. Naturwissenschaftliche Reihe, Band XI., Dresden und Leipzig. Verlag von Theodor Steinkopff, 1924. 4·50 marks.

DURING the last few years very great advances have been made in our knowledge of the dynamics of the atmosphere. The atmosphere as we know it now is a very different atmosphere from the one which we thought we knew twenty years ago. The work of Dines and Shaw in this country, and of Bjerknes, Exner, Sandström and Ficker on the Continent—to mention only a few names—has taught us the importance of the physical constitution of the masses of air, the interplay of which gives us our weather. The results of this new work have been published in a constant stream of original papers appearing in many different journals and magazines and in many different languages, all revolutionising our ideas of the processes which take place in the atmosphere, especially in that part of the atmosphere where cyclones and anticyclones move and have their being. New words have been introduced, and miles of new and unfamiliar formulæ have been written down. Unfortunately some of the new words have not proved successful, and have had to be abandoned or modified. Many of the new ideas are isolated, and several writers have discussed the same phenomenon from different points of view, coming to different conclusions, and only agreeing when they show that our old conceptions were wrong or incomplete. It must be confessed that many of us whose business it is to keep abreast of the progress of meteorology have

at times been bewildered with the mass of new ideas and longed for someone to co-ordinate the results, to separate the corn from the chaff, and to give us a clear idea of where we are going.

In some ways this small book on weather forecasting does achieve this end, if only imperfectly. It is really an attempt to apply the results of this new work to the daily business of forecasting the weather. But too much has been attempted in too small a space. To one who is familiar with the original papers, it is interesting and understandable, but we feel that the ordinary student taking this as his introduction to the practice of weather forecasting will experience not a few difficulties. Still the book is a good book, and contains a wonderful lot in its 111 pages. It will be very welcome, and no one can read it through without getting a general idea of the lines along which progress is being made. We cannot hope to describe the contents of the book in this short review. It must be sufficient to say that Dr. Georgii is an ardent disciple of the Bjerknes school, although he gives a clear account of the opposing theory of cyclone building propounded by Professor Exner. The old method of referring the weather to the form of the isobars now gives place to a critical study of lines of flow and lines of discontinuity. To quote Dr. Georgii: "Although charts of lines of flow will never supersede isobaric charts in practical weather forecasting, they must be placed side by side with them as of at least equal value."

We strongly recommend every one who has a practical interest in meteorology to read this book and then go to the original papers, to which full references are given, when difficulties are encountered. G.C.S.

News in Brief

WE regret to announce the death on January 3rd, 1925, at Borden Wood, Liphook, of Mr. Edmund G. Lamb, who has contributed rainfall observations to the British Rainfall Organization for 25 years (1900-1924). From 1906 to 1910, Mr. Lamb was the Liberal member for the Leominster Division of Herefordshire.

On Sunday, December 21st, Dr. G. C. Simpson, C.B.E., F.R.S., delivered a lecture on *Clouds* at the Guildhouse, London. This formed one of a series of lectures being given at the Guildhouse on Sunday afternoons on *Science in Relation to Life.*

Dr. Simpson has been appointed President of Section A (Mathematics and Physics) for the Southampton meeting of the British Association for the Advancement of Science.

A lecture on the *Measurement of the Pressure of the Wind on Structures* was given by Dr. T. E. Stanton at the Institution of Civil Engineers on December 16th.

On Friday, January 2nd, the Geographical Association held a discussion at the London School of Economics on "The Life of the Fiord Peoples." Mr. J. Fairgrieve gave an account of the present social conditions in Norway, Mr. C. E. P. Brooks discussed the influence of climatic changes during the past three thousand years on the life of the Norwegian peoples, and especially on their seafaring activities, and Dr. A. Sommerfelt read a paper on the economic history of Norway and its effect on present conditions.

According to the *Fruit Grower*, thousands of toy balloons are to be released next spring from fifteen weather stations, extending from northern Connecticut nearly to the Canadian border, in an endeavour to discover the secrets of the winds responsible for the westward spread of the Gypsy moth, which is carried when in the caterpillar stage for distances ranging from half-a-mile to five miles.

The Weather of December, 1924

MILD, unsettled weather with winds between south and south-west prevailed generally throughout the greater part of December. During the first week rain fell on several days and thunderstorms sometimes accompanied by hail, occurred locally, but there were many bright intervals, 6 or 7 hours sunshine being recorded at several stations on the 5th and 6th. Early morning mist and fog were experienced locally, and on the afternoon of the 2nd, intense gloom prevailed in and around London. On the 7th, south and south-easterly breezes caused a drop in the temperature in the south-eastern districts, and, as the anticyclone over central Europe extended westwards, the cold, foggy conditions prevalent on the continent spread also to England. On the 10th and 11th the fog was especially dense, and extended over Germany, France, the Netherlands and England.* In England, maximum temperature readings of below 35° F. were registered at a few stations on both these days; at Wisley and Wallington the maximum reading on the 10th was 32° F. In Ireland and north-west Scotland the mild unsettled weather with south-westerly winds had continued during this time, and after the 12th, when heavy rain occurred in parts of Ireland and Scotland, *e.g.*, 117 mm. (4·62 in.) at Delphi (Mayo), 114 mm. (4·50 in.) at Aasleagh (Mayo), and 50 mm. (1·97 in.) at Achnashellach (Rossshire), these conditions began to spread again over the whole of the British Isles. High winds and gales were experienced at exposed places on the 13th, and snow and sleet occurred at

* See pp. 277-284.

Oundle and Wisley on the same day. From the 17th to the 22nd there was another spell of drier weather in England (except the west), but, after this, strong winds frequently rising to gale force and heavy rain alternating with bright periods predominated over the whole country until the end of the month. South-westerly winds of about 60 m.p.h. (Beaufort force 10) occurred in the Shetlands on the 25th, and in the English Channel on the 27th, while gusts of over 70 m.p.h. were recorded at a few places on most of the days from the 25th to 31st, *e.g.*, a gust of 90 m.p.h. occurred at Lerwick on the 25th, of 79 m.p.h. at Edinburgh on the 27th and 29th, and of 73 m.p.h. at Shoeburyness on the 31st. Thunderstorms occurred on several occasions, and the rainfall was heavy, especially on the 26th and 29th, when between 63 mm. (2·5 in.) and 89 mm. (3·5 in.) were measured at some stations in the West. Dungeon Ghyll (Westmoreland) had as much as 93 mm. (3·65 in.) on the 26th. Temperature was generally high during the month; maximum readings of over 57° F. were recorded on several days and 60° F. was reached at Colmonell (Ayrshire) on the 23rd. Very little snow was reported until the end of the month, when showers of snow or sleet fell in many parts of Scotland and at a few places in Ireland and England. The total rainfall for the month varied from a little below normal in parts of north-east England (Skegness had only 72 per cent.) to nearly twice the normal in eastern Scotland, where Braemar Bank (Aberdeenshire) had 199 per cent.

Pressure was below normal over Norway, the northern part of the Atlantic Ocean and Spitzbergen and very low over Iceland where the maximum deficit was at Reykjavik, 18·8 mb. There was a large area of high pressure covering central and eastern Europe and extending well into Russia. This pressure distribution was very favourable for strong south-westerly winds over the British Isles and Scandinavia. Temperature was above normal over the whole of Europe, the excess being 11° F. at Spitzbergen, 10° F. at Haparanda, and 2° F. at Lisbon and Zurich. Precipitation was slightly above normal in north-west Europe, but deficient in central Europe. The anticyclone which established itself over west Russia on the 5th spread westwards, and on the 17th had extended to south of the Azores. It remained almost stationary until nearly the end of the month. Over Russia and central Europe there was much fog or mist, but comparatively warm weather over north-west Europe. Depressions alternated with fair intervals during which much fog and some very low temperatures were experienced. Later, conditions became more stormy and there were many gales accompanied by heavy rain. Early in the month bad weather was experienced over the Mediterranean, but the central European anticyclone

brought more stable conditions, and by the 12th fine weather was established. On the 1st, a violent storm swept across Nice and much damage was done. On the 3rd, a storm was felt over the whole peninsula of Spain. From the 8th to the 11th the heavy fog over Belgium and Germany caused serious interruption to rail and shipping traffic. France also suffered from fogs during the month, and, as in England, the last few days were marked by storms on the Atlantic and Channel coasts. In Switzerland, the weather was fine and dry with little snow until the 29th, when the winter sports were able to begin.

Canada and the United States suffered from intense cold in the middle of the mouth. Heavy snowstorms held up railway traffic in west Canada ; a temperature of —44° F. was reported from Edmonton in Alberta on the night of the 16th-17th. Schools were closed until the weather moderated. The abnormally cold weather was also felt in all the States west of the Mississippi : at Miles City, Montana, a temperature of —44° F. was reported on the 19th. There was another wave of intense cold over America at the end of the month.

Snow fell in Baghdad on the 26th. This was the first fall for 14 years and was followed by 8° F. of frost. Fog in Japan, on the 12th, was responsible for a shipping accident, when a naval repair ship ran on a reef and 100 seamen were drowned.

Reports from Australia show that there was a deficiency of rain in western Australia and Tasmania, in the latter region only 39 per cent. of the normal amount of rain fell. There was an excess of rain in parts of Queensland and New South Wales. The extreme south-east coast of New South Wales received more than twice the normal (237 per cent.). Elsewhere the rainfall was about normal. There was a storm in Sydney on the 23rd, when a wind of 70 m.p.h. was reported and traffic was seriously affected.

The special message from Brazil states that the rainfall was heavy (113 mm. above normal) in the central districts, and irregular (29 mm. above normal) in the southern districts. Reports from the northern districts are missing. Crops are generally good, except that some of them have been damaged by the excessive rains in the central districts where floods have occurred. At Rio de Janeiro, pressure was 0·7 mb. above normal, and temperature 0·5° F. below normal.

Rainfall—General Distribution

	Dec.	Year	
England and Wales	124	121	per cent. of the average 1881-1915.
Scotland	125	105	
Ireland	140	122	
British Isles	127	117	

Rainfall: December, 1924 England and Wales

CO.	STATION.	In.	mm.	Per-cent. of Av	CO.	STATION.	In.	mm.	Per-cent. of Av.
Lond.	Camden Square.....	3·18	81	133	*War.*	Birminghm, Edgbaston	3·41	87	127
Sur .	Reigate, Hartswood...	4·04	103	135	*Leics*	Leicester Town Hall...	1·51	38	...
Kent.	Tenterden, View Tower	5·00	127	161	,, .	Belvoir Castle.....	2·82	72	115
,, .	Folkestone, Boro. San.	2·99	76	...	*Rut .*	Ridlington.....	2·54	65	...
,, .	Broadstairs	1·53	39	64	*Linc.*	Boston, Skirbeck	1·83	47	85
,, .	Sevenoaks, Speldhurst.	4·11	104	...	,, .	Lincoln, Sessions House	2·21	56	101
Sus .	Patching Farm.....	5·20	132	155	,, .	Skegness, Estate Office.	1·59	41	72
,, .	Eastbourne, Wilm. Sq.	4·60	117	132	,, .	Louth, Westgate	2·50	63	90
,, .	Tottingworth Park....	5·93	151	160	,, .	Brigg	2·00	51	82
Hants	Totland Bay, Aston...	4·09	104	127	*Notts.*	Worksop, Hodsock....	2·25	57	95
,, .	Fordingbridge, Oaklnds	6·24	159	158	*Derby*	Mickleover, Clyde Ho..	2·69	68	102
,, .	Portsmouth, Vic. Park.	4·09	104	131	,, .	Buxton, Devon. Hos...	4·91	125	87
,, .	Ovington Rectory	7·29	185	184	*Ches.*	Runcorn, Weston Pt...	3·09	79	98
,, .	Grayshott	5·68	144	149	,, ..	Nantwich, Dorfold Hall	3·20	81	...
Berks	Wellington College...	3·78	96	131	*Lancs*	Bolton, Queen's Park .	4·77	121	...
,, .	Newbury, Greenham..	5·66	144	177	,, ..	Stonyhurst College....	4·93	125	102
Herts.	Bennington House....	2·98	76	120	,, ..	Southport, Hesketh...	4·31	109	133
Bucks	High Wycombe	4·72	120	161	,, ..	Lancaster, Strathspey.	6·72	171	...
Oxf..	Oxford, Mag. College..	4·17	106	180	*Yorks*	Sedbergh, Akay	11·16	283	190
Nor .	Pitsford, Sedgebrook..	3·45	88	143	,, .	Wath-upon-Dearne	1·86	47	78
,, .	Eye, Northolm.....	1·43	36	...	,, .	Bradford, Lister Pk...	4·27	108	128
Beds.	Woburn, Crawley Mill.	3·64	93	154	,, .	Oughtershaw Hall	13·43	341	...
Cam.	Cambridge, Bot. Gdns.	2·29	58	119	,, .	Wetherby, Ribston H..	2·70	69	110
Essex	Chelmsford, CountyLab	2·96	75	...	,, .	Hull, Pearson Park ...	2·25	57	93
,, .	Lexden, Hill House..	2·57	65	...	,, .	Holme-on-Spalding ...	2·65	67	...
Suff .	Hawkedon Rectory ...	2·05	52	85	,, .	Lowthorpe, The Elms.	2·42	61	90
,, .	Haughley House.....	1·71	43	...	,, .	West Witton, Ivy Ho..	5·37	136	...
Norf.	Beccles, Geldeston....	2·35	60	102	,, .	Pickering, Hungate ...	2·14	54	...
,, .	Norwich, Eaton	2·96	75	113	,, .	Middlesbrough	2·64	67	136
,, .	Blakeney	1·58	40	71	,, .	Baldersdale, Hury Res.	5·74	146	140
,, .	Swaffham	2·17	55	91	*Durh.*	Ushaw College	2·66	67	106
Wilts.	Devizes, Highclere....	4·73	120	155	*Nor .*	Newcastle, Town Moor.	2·30	58	95
Dor .	Evershot, Melbury Ho.	7·21	183	140	,, .	Bellingham Manor....	4·25	108	...
,, .	Weymouth, Westham..	4·93	125	142	,, .	Lilburn Tower Gdns...	3·13	79	...
,, .	Shaftesbury, Abbey Ho.	4·85	123	134	*Cumb*	Penrith, Newton Rigg..	...	...	...
Devon	Plymouth, The Hoe...	3·68	93	74	,, .	Carlisle, Scaleby Hall .	4·46	113	139
,, .	Polapit Tamar	7·20	183	141	,, .	Seathwaite	24·50	622	150
,, .	Ashburton, Druid Ho..	10·85	276	144	*Glam.*	Cardiff, Ely P. Stn.....	6·47	164	127
,, .	Cullompton	3·73	95	85	,, .	Treherbert, Tynywaun	16·95	431	...
,, .	Sidmouth, Sidmount ..	3·78	96	96	*Carm*	Carmarthen Friary....	9·85	250	172
,, .	Filleigh, Castle Hill ...	6·11	155	...	,, .	Llanwrda, Dolaucothy.	11·45	291	163
,, .	Hartland Abbey.....	5·59	142	...	*Pemb*	Haverfordwest, Portf'd	7·95	202	139
Corn.	Redruth, Trewirgie ...	9·21	234	147	*Card.*	Gogerddan.....	6·73	171	134
,, .	Penzance, Morrab Gdn.	5·92	150	104	,, .	Cardigan,County Sch. .	7·52	191	...
,, .	St. Austell, Trevarna..	6·55	166	108	*Brec .*	Crickhowell, Talymaes	9·00	229	...
Soms	Chewton Mendip	5·54	141	103	*Rad .*	Birm.W.W.Tyrmynydd	9·59	244	117
,, .	Street, Hind Hayes ...	3·33	85	...	*Mont.*	Lake Vyrnwy	8·32	211	121
Glos..	Clifton College	5·72	145	149	*Denb.*	Llangynhafal	3·48	88	...
,, .	Cirencester	5·10	129	148	*Mer .*	Dolgelly, Bryntirion..	7·71	196	113
Here.	Ross, County Obsy. ...	4·03	102	136	*Carn.*	Llandudno	3·95	100	127
,, .	Ledbury, Underdown.	2·83	72	101	,, .	Snowdon, L. Llydaw 9	23·87	606	...
Salop	Church Stretton.....	4·89	124	146	*Ang .*	Holyhead, Salt Island.	4·83	123	116
,, .	Shifnal, Hatton Grange	2·87	73	112	,, .	Lligwy	6·45	164	...
Staff.	Tean, The Heath Ho...	3·01	76	92	*Isle of Man*				
Worc.	Ombersley, Holt Lock.	3·14	80	120		Douglas, Boro' Cem...	6·12	155	122
,, .	Blockley, Upton Wold.	3·31	84	102	*Guernsey*				
War.	Farnborough.....	3·97	101	135		St. Peter Port, Grange.	4·51	114	110

Rainfall: December, 1924: Scotland and Ireland

CO.	STATION	In.	mm.	Per-cent. of Av.	CO.	STATION.	In.	mm.	Per-cent. of Av.
Wigt.	Stoneykirk, Ardwell Ho	4·45	113	109	*Suth.*	Loch More, Achfary	9·97	253	108
„	Pt. William, Monreith	4·78	121	...	*Caith*	Wick	1·48	38	48
Kirk.	Carsphairn, Shiel.	12·54	319	...	*Ork.*	Pomona, Deerness	2·26	57	54
„	Dumfries, Cargen	9·42	239	174	*Shet.*	Lerwick	7·75	197	162
Dum	Drumlanrig	8·85	225	169					
Roxb	Branxholme	5·93	151	162	*Cork.*	Caheragh Rectory	10·25	260	...
Selk.	Ettrick Manse	12·25	311	...	„	Dunmanway Rectory	10·67	271	133
Berk.	Marchmont House	3·58	91	127	„	Ballinacurra	6·60	168	129
Hadd	North Berwick Res.	1·68	43	78	„	Glanmire, Lota Lo.	8·11	206	147
Midl	Edinburgh, Roy. Obs.	3·07	78	142	*Kerry*	Valencia Obsy.	9·76	248	147
Lan.	Biggar	4·32	110	128	„	Gearahameen	16·70	424	...
Ayr.	Kilmarnock, Agric. C.	4·67	119	109	„	Killarney Asylum	10·86	276	149
„	Girvan, Pinmore	6·31	160	105	„	Darrynane Abbey	8·87	225	151
Renf.	Glasgow, Queen's Pk.	6·03	153	143	*Wat.*	Waterford, Brook Lo.	6·45	164	138
„	Greenock, Prospect H.	11·28	287	143	*Tip.*	Nenagh, Cas. Lough	8·49	216	184
Bute.	Rothesay, Ardencraig	7·38	187	135	„	Tipperary	5·95	151	...
„	Dougarie Lodge	4·67	119	...	„	Cashel, Ballinamona	5·07	129	117
Arg.	Glen Etive	...	...	...	*Lim.*	Foynes, Coolnanes	7·03	178	149
„	Oban	9·22	234	...	„	Castleconnell Rec.	7·12	181	...
„	Poltalloch	7·80	198	123	*Clare*	Inagh, Mount Callan	10·55	268	...
„	Inveraray Castle	11·51	292	116	„	Broadford, Hurdlest'n.	9·12	232	...
„	Islay, Eallabus	7·83	199	132	*Wexf*	Newtownbarry	6·45	164	...
„	Mull, Benmore	15·40	391	...	„	Gorey, Courtown Ho.	6·38	162	167
Kinr.	Loch Leven Sluice	5·01	127	127	*Kilk.*	Kilkenny Castle	4·83	123	140
Perth	Loch Dhu	14·00	356	139	*Wic.*	Rathnew, Clonmannon	6·24	159	...
„	Balquhidder, Stronvar.	12·91	328	135	*Carl.*	Hacketstown Rectory	4·92	125	120
„	Crieff, Strathearn Hyd.	8·38	213	187	*QCo.*	Blandsfort House	5·49	139	149
„	Blair Castle Gardens	6·36	161	...	„	Mountmellick	5·81	148	...
„	Coupar Angus School	4·05	103	135	*KCo.*	Birr Castle	5·37	136	163
Forf.	Dundee, E. Necropolis	4·02	102	151	*Dubl.*	Dublin, FitzWm. Sq.	4·43	113	179
„	Pearsie House	6·43	163	...	„	Balbriggan, Ardgillan	4·30	109	149
„	Montrose, Sunnyside	3·45	88	124	*Me'th*	Drogheda, Mornington	3·90	99	...
Aber.	Braemar Bank	7·10	180	199	*W.M*	Mullingar, Belvedere	5·65	143	154
„	Logie Coldstone Sch.	2·56	65	91	*Long*	Castle Forbes Gdns.	5·19	132	130
„	Aberdeen, Cranford Ho	3·73	95	107	*Gal.*	Galway, Waterdale	...	..	...
„	Fyvie Castle	1·74	44	...	„	Ballynahinch Castle	12·27	312	...
Mor.	Gordon Castle	0·94	24	35	*Mayo*	Mallaranny	11·58	294	...
„	Grantown-on-Spey	1·90	48	70	„	Westport House	9·80	249	170
Nn	Nairn, Delnies	2·38	60	107	„	Delphi Lodge	22·22	564	...
Inv.	Ben Alder Lodge	13·68	347	...	*Sligo*	Markree Obsy.	5·38	137	112
„	Kingussie, The Birches	4·88	124	...	*Ferm*	Enniskillen, Portora	5·09	129	...
„	Fort Augustus	...	...	...	*Arm.*	Armagh Obsy.	4·05	103	129
„	Loch Quoich, Loan	25·50	648	...	*Down*	Warrenpoint	3·77	96	...
„	Glenquoich	22·77	578	155	„	Seaforde	6·30	160	153
„	Inverness, Culduthel R.	4·22	107	...	„	Donaghadee	2·95	75	93
„	Arisaig, Faire-na-Squir	10·08	256	...	„	Banbridge, Milltown	2·29	58	79
„	Fort William	15·13	384	150	*Antr.*	Belfast, Cavehill Rd.	4·77	121	...
„	Skye, Dunvegan	10·12	257	...	„	Glenarm Castle	5·54	141	...
„	Barra, Castlebay	2·88	73	...	„	Ballymena, Harryville	4·91	125	111
R&C	Alness, Ardross Cas.	4·45	113	108	*Lon.*	Londonderry, Creggan	4·96	126	113
„	Ullapool	6·64	169	...	*Tyr.*	Donaghmore	5·94	151	...
„	Torridon, Bendamph.	18·21	463	179	„	Omagh, Edenfel	4·97	126	118
„	L. Carron, Plockton	...	...	...	*Don.*	Malin Head	5·50	140	164
„	Stornoway	9·23	235	148	„	Rathmullen	5·08	129	...
Suth.	Lairg	2·36	60	...	„	Duntanaghy	7·61	193	147
„	Tongue Manse	3·28	83	66	„	Killybegs, Rockmount	...	...	...
„	Melvich School	2·21	56	51					

Climatological Table for the British Empire, July, 1924

STATIONS	PRESSURE		TEMPERATURE							Relative Humidity	Mean Cloud Am'nt	PRECIPITATION			BRIGHT SUNSHINE	
			Absolute		Mean Values											
	Mean of Day M.S.L.	Diff. from Normal	Max.	Min.	Max.	Min.	½ max. and min.	Diff. from Normal	Mean Wet Bulb.			Am'nt	Diff. from Normal	Days	Hours per day	Percentage of possible.
	mb.	mb.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	%	0—10	mm.	mm.			
London, Kew Obsy.	1012·6	— 3·2	86	45	70·9	53·4	62·1	— 0·6	56·7	70	6·0	95	+ 40	16	7·4	46
Gibraltar	1016·0	— 0·8	91	63	83·2	67·6	75·4	+ 0·6	67·2	68	2·5	0·3	— 1	1	...	...
Malta	1013·7	— 0·3	97	68	85·1	72·8	78·9	+ 1·4	70·5	65	0·9	1	0	1	11·6	81
Sierra Leone	1013·7	+ 0·3	87	69	82·9	71·5	77·2	— 1·8	74·1	83	7·5	745	—131	25	...	...
Lagos, Nigeria	1011·7	— 2·1	87	73	84·2	75·4	79·8	+ 2·5	75·4	77	5·7	63	—206	9	...	...
Kaduna, Nigeria	1015·8	+ 1·8	88	60	83·4	66·5	74·9	+ 1·3	70·9	86	1·5	324	+ 92	22	...	...
Zomba, Nyasaland	1018·8	+ 0·9	76	46	72·0	51·6	61·8	+ 0·1	...	87	5·5	13	+ 6	5	...	...
Salisbury, Rhodesia	1019·9	— 1·0	76	33	70·5	41·8	56·1	0·0	48·5	54	1·3	0	— 1	0	...	...
Cape Town	1021·8	+ 0·5	79	37	63·8	47·3	55·5	+ 0·6	52·1	80	4·2	40	— 50	13	...	...
Johannesburg	1025·5	— 0·2	71	30	60·5	39·8	50·1	— 0·5	37·2	49	1·2	0	— 6	0	9·6	91
Mauritius	1019·8	— 0·6	78	58	74·8	63·3	69·1	+ 0·8	64·6	78	5·8	65	+ 2	21	7·2	65
Bloemfontein	...	...	71	18	61·7	27·3	44·5	— 2·8	33·7	65	1·0	0	— 10	0	...	...
Calcutta, Alipore Obsy.	997·6	— 1·6	93	77	89·5	80·2	84·9	+ 1·4	80·3	89	9·6	264	— 63	*12	...	...
Bombay	1002·0	— 1·7	90	75	85·3	79·0	82·1	+ 1·0	74·6	70	9·5	425	—214	*23	...	...
Madras	1003·6	— 0·9	100	74	95·8	78·4	87·1	— 0·2	76·9	69	7·0	143	+ 39	*10	...	...
Colombo, Ceylon	1008·9	+ 0·8	87	71	85·4	76·4	80·9	— 0·4	77·8	76	8·9	350	+220	24	5·1	41
Hong Kong	1004·1	— 0·8	89	76	86·4	78·4	82·4	— 0·1	77·8	83	7·9	499	+180	23	6·4	48
Sandakan	...	...	93	73	89·1	75·3	82·2	+ 0·3	76·9	78	...	284	+118	18	...	...
Sydney	1023·7	+ 5·2	71	41	63·7	46·7	55·2	+ 2·8	50·0	69	4·1	40	— 83	6	5·8	57
Melbourne	1024·2	+ 5·1	61	33	55·8	41·9	48·9	+ 0·3	46·5	77	5·7	22	— 24	12	4·1	41
Adelaide	1024·7	+ 4·3	69	37	61·8	45·4	53·6	+ 2·0	48·5	70	4·7	16	— 51	12	5·0	50
Perth, W. Australia	1019·7	+ 0·6	74	40	65·5	49·4	57·5	+ 2·4	51·7	67	5·3	96	— 70	16	5·6	55
Coolgardie	1021·7	+ 1·8	74	34	66·0	41·2	53·6	+ 2·4	48·5	49	3·1	8	— 15	3	...	...
Brisbane	1022·5	+ 4·2	77	46	69·3	53·2	61·3	+ 3·0	57·7	74	5·1	135	+ 79	12	6·0	57
Hobart, Tasmania	1019·1	+ 5·3	61	32	52·4	40·2	46·3	+ 0·9	43·0	77	5·6	23	— 31	13	4·0	43
Wellington, N.Z.	1020·8	+ 7·9	61	32	54·3	41·9	48·1	+ 0·6	44·4	75	5·6	75	— 69	14	4·7	49
Suva, Fiji	1014·5	+ 0·3	84	62	78·1	68·4	73·3	— 0·3	68·9	81	6·1	130	+ 13	23	...	...
Apia, Samoa	1010·5	— 1·5	86	70	84·0	74·1	79·0	+ 2·0	75·7	81	5·3	244	+171	20	7·0	61
Kingston, Jamaica	1014·4	— 0·3	93	70	90·3	73·1	81·7	0·0	74·8	67	5·7	33	— 9	8	...	...
Grenada, W.I.	1014·0	+ 0·7	88	70	83·9	74·1	79·0	+ 0·1	75·3	79	5·9	456	+207	22	...	...
Toronto	1014·7	+ 0·6	88	48	77·7	56·9	67·3	— 0·9	60·8	71	3·5	106	+ 29	13	10·0	66
Winnipeg	1013·6	+ 0·9	91	38	77·4	54·7	66·1	— 0·1	62·0	64	4·2	76	— 1	9	9·5	60
St. John, N.B.	1012·1	— 1·6	83	48	69·2	51·7	60·5	+ 0·1	56·1	82	6·0	43	— 49	11	8·2	54
Victoria, B.C.	1017·8	+ 1·1	92	48	68·0	51·7	59·9	— 0·4	53·6	75	3·0	8	— 1	5	10·8	69

* For Indian stations a rain day is a day on which 0·1 in. (2·5 mm.) or more rain has fallen.

Toronto	1014·7	+ 0·6	88	48	77·7	56·9	67·3	— 0·9	60·8	71	3·5	106	+ 29	13	10·0	66
Winnipeg	1013·6	+ 0·9	91	38	77·4	54·7	66·1	— 0·1	62·0	64	4·2	76	— 1	9	9·5	60
St. John, N.B.	1012·1	— 1·6	83	48	69·2	51·7	60·5	+ 0·1	56·1	82	6·0	43	— 49	11	8·2	54
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